SEQUENCE LISTING

<110> National University of Singapore
Sin, Yoke Min
Teh, Hsiao Chuin
Lim, Sze Yun

<120> Oral Vaccine, Method for its Preparation and Use Thereof

<130> 2500-000017

<140> US 10/725,188
<141> 2003-12-01

<160> 9

<170> PatentIn version 3.3

<210> 1
<211> 1810
<212> DNA
<213> Aeromonas hydrophila

<220>
<221> 5'UTR
<222> (1)..(480)

<220>
<221> CDS
<222> (481)..(1599)

<220>
<221> sig_peptide
<222> (481)..(540)

<220>
<221> mat_peptide
<222> (541)..(1599)

<220>
<221> 3'UTR
<222> (1603)..(1810)

<400> 1
gtaatacgac tcactatagg gcgaattggg tacacttacc tggtacccca cccgggtgga 60

aaatcgatgg gcccgcggcc gctctagaag tactctcgag aagctttttg aattctttgg 120

atcctcggcg tgggccatgg cctgttcggc gggttcgctc tgccagcggt tggggccgag 180

gtgatccgac ctcttcttct atttataagg cgagtcgtcg ttattgtgtg ataaatcacc 240

aattcggacg aattttgcca gcggttatcg ctgtaaacgt tttcccatgg cgtgcaaaca 300

atgtgggatt caggtcacaa tttttccgct gtgactatgc ttttcgtaaa aagttccaag 360

```
ttttttcatt gcggattgga aaacccggtg ctagtctcgg cgccatagtg atgcaaagta    420

catcgctaac acagggaata acaacgactt agtgtttaat tacagtaggc attggaaact    480

atg aaa aag aca att ctg gct att gct atc ccg gct ctg ttt gca tcc      528
Met Lys Lys Thr Ile Leu Ala Ile Ala Ile Pro Ala Leu Phe Ala Ser
-20                 -15                 -10                 -5

gcc gct aac gct gca gtg gtt tac gac aaa gac ggt acc act ttt gac      576
Ala Ala Asn Ala Ala Val Val Tyr Asp Lys Asp Gly Thr Thr Phe Asp
            -1  1               5                   10

gta tac ggc cgt gtt cag gct aac tac tac ggt gac cac aac aaa tct      624
Val Tyr Gly Arg Val Gln Ala Asn Tyr Tyr Gly Asp His Asn Lys Ser
        15                  20                  25

gta gct gct acc gat ggt tcc tgg ggc ttc agc gga act ggt acc ccg      672
Val Ala Ala Thr Asp Gly Ser Trp Gly Phe Ser Gly Thr Gly Thr Pro
    30                  35                  40

gaa tat act cct ggt acc gct gct cat tac tct gat gtt gat ggt gag      720
Glu Tyr Thr Pro Gly Thr Ala Ala His Tyr Ser Asp Val Asp Gly Glu
45                  50                  55                  60

ctg gtt ggt tct tcc cgt ctg ggt tgg tcc ggt aag att gcc ctg aac      768
Leu Val Gly Ser Ser Arg Leu Gly Trp Ser Gly Lys Ile Ala Leu Asn
                65                  70                  75

aac acc tgg tcc ggt atc gcc aag act gag tgg caa gtt tct gct gaa      816
Asn Thr Trp Ser Gly Ile Ala Lys Thr Glu Trp Gln Val Ser Ala Glu
            80                  85                  90

aac tcc gcc aac aag ttc gat tcc cgt cac atc tac gtt ggt ttc gac      864
Asn Ser Ala Asn Lys Phe Asp Ser Arg His Ile Tyr Val Gly Phe Asp
        95                  100                 105

ggc acc cag tac ggt aag atc atc ttc ggt cag acc gat acc gcg ttc      912
Gly Thr Gln Tyr Gly Lys Ile Ile Phe Gly Gln Thr Asp Thr Ala Phe
    110                 115                 120

tat gac gtg ctg gaa ccg acc gat atc ttc aac gag tgg ggc gac gta      960
Tyr Asp Val Leu Glu Pro Thr Asp Ile Phe Asn Glu Trp Gly Asp Val
125                 130                 135                 140

ggt aac ttc tat gac ggt cgt caa gaa ggt cag atc atc tac tcc aac     1008
Gly Asn Phe Tyr Asp Gly Arg Gln Glu Gly Gln Ile Ile Tyr Ser Asn
                145                 150                 155

acc tac ggt ggc ttc aaa ggc aaa ctg tcc tat caa acc aac gac gac     1056
Thr Tyr Gly Gly Phe Lys Gly Lys Leu Ser Tyr Gln Thr Asn Asp Asp
            160                 165                 170

aag gcc gtc aag gtt act gac gta ggt cag ggc atc aaa gaa aac gca     1104
Lys Ala Val Lys Val Thr Asp Val Gly Gln Gly Ile Lys Glu Asn Ala
        175                 180                 185
```

```
gtg tac ggc aag gat gtt aag cgt aac tac ggt tat gcc gcg gct gcc     1152
Val Tyr Gly Lys Asp Val Lys Arg Asn Tyr Gly Tyr Ala Ala Ala Ala
    190                 195                 200

ggt tat gac ttc gac ttc ggt ctg ggt ctg aac gca ggt tac tcc tac     1200
Gly Tyr Asp Phe Asp Phe Gly Leu Gly Leu Asn Ala Gly Tyr Ser Tyr
205                 210                 215                 220

tcc gat ctg gaa aat acc gca acc aac aac act ggc gac aag aaa gag     1248
Ser Asp Leu Glu Asn Thr Ala Thr Asn Asn Thr Gly Asp Lys Lys Glu
                225                 230                 235

tgg gca ctg ggt gca cac tac gcc atc aac ggt ttc tac ttc gcc ggt     1296
Trp Ala Leu Gly Ala His Tyr Ala Ile Asn Gly Phe Tyr Phe Ala Gly
            240                 245                 250

gtc tac acc cag gca gat ctg agc tat gac acc acc acc ggt ggt gac     1344
Val Tyr Thr Gln Ala Asp Leu Ser Tyr Asp Thr Thr Thr Gly Gly Asp
        255                 260                 265

aag gac aag ggc cgt ggc tac gag ctg gct gct tcc tac aac gtt gat     1392
Lys Asp Lys Gly Arg Gly Tyr Glu Leu Ala Ala Ser Tyr Asn Val Asp
    270                 275                 280

gcc tgg act ttc ctg gcc ggc tac aac ttc act gaa ggt aaa gtt gct     1440
Ala Trp Thr Phe Leu Ala Gly Tyr Asn Phe Thr Glu Gly Lys Val Ala
285                 290                 295                 300

tcc aac acc gct ggt gct gag tac aaa gac atc gtt gac gaa acc ctg     1488
Ser Asn Thr Ala Gly Ala Glu Tyr Lys Asp Ile Val Asp Glu Thr Leu
                305                 310                 315

ctg ggc gta cag tac gct ttc act tcc aag ctg aaa gcc tac acc gag     1536
Leu Gly Val Gln Tyr Ala Phe Thr Ser Lys Leu Lys Ala Tyr Thr Glu
            320                 325                 330

tac aag atc cag ggt atc gac aag atg gac gac gag tgg acc gtt gcc     1584
Tyr Lys Ile Gln Gly Ile Asp Lys Met Asp Asp Glu Trp Thr Val Ala
        335                 340                 345

ctg caa tac aac ttc taatctagcc tctgcgttga tttagatgat gaacggccaa     1639
Leu Gln Tyr Asn Phe
    350

gcttgcttgg ccgttttgtt ttatctgctt cccacctgat gtttctgttc tcttctgttg   1699

attatcttct ccttgccctc tttgacttgc gtcagttcac gttgtctctt ttctgtactt   1759

ggctcccggg cagcggatcg ctagattatt cagctcgttg caggatgtaa a            1810
```

<210> 2
<211> 373
<212> PRT
<213> Aeromonas hydrophila

<400> 2

```
Met Lys Lys Thr Ile Leu Ala Ile Ala Ile Pro Ala Leu Phe Ala Ser
-20                 -15                 -10                  -5

Ala Ala Asn Ala Ala Val Val Tyr Asp Lys Asp Gly Thr Thr Phe Asp
            -1  1               5                  10

Val Tyr Gly Arg Val Gln Ala Asn Tyr Tyr Gly Asp His Asn Lys Ser
        15                  20                  25

Val Ala Ala Thr Asp Gly Ser Trp Gly Phe Ser Gly Thr Gly Thr Pro
    30                  35                  40

Glu Tyr Thr Pro Gly Thr Ala Ala His Tyr Ser Asp Val Asp Gly Glu
45                  50                  55                  60

Leu Val Gly Ser Ser Arg Leu Gly Trp Ser Gly Lys Ile Ala Leu Asn
                65                  70                  75

Asn Thr Trp Ser Gly Ile Ala Lys Thr Glu Trp Gln Val Ser Ala Glu
            80                  85                  90

Asn Ser Ala Asn Lys Phe Asp Ser Arg His Ile Tyr Val Gly Phe Asp
        95                  100                 105

Gly Thr Gln Tyr Gly Lys Ile Ile Phe Gly Gln Thr Asp Thr Ala Phe
    110                 115                 120

Tyr Asp Val Leu Glu Pro Thr Asp Ile Phe Asn Glu Trp Gly Asp Val
125                 130                 135                 140

Gly Asn Phe Tyr Asp Gly Arg Gln Glu Gly Gln Ile Ile Tyr Ser Asn
                145                 150                 155

Thr Tyr Gly Gly Phe Lys Gly Lys Leu Ser Tyr Gln Thr Asn Asp Asp
            160                 165                 170

Lys Ala Val Lys Val Thr Asp Val Gly Gln Gly Ile Lys Glu Asn Ala
        175                 180                 185

Val Tyr Gly Lys Asp Val Lys Arg Asn Tyr Gly Tyr Ala Ala Ala Ala
    190                 195                 200
```

```
Gly Tyr Asp Phe Asp Phe Gly Leu Gly Leu Asn Ala Gly Tyr Ser Tyr
205                 210                 215                 220

Ser Asp Leu Glu Asn Thr Ala Thr Asn Asn Thr Gly Asp Lys Lys Glu
                225                 230                 235

Trp Ala Leu Gly Ala His Tyr Ala Ile Asn Gly Phe Tyr Phe Ala Gly
            240                 245                 250

Val Tyr Thr Gln Ala Asp Leu Ser Tyr Asp Thr Thr Thr Gly Gly Asp
        255                 260                 265

Lys Asp Lys Gly Arg Gly Tyr Glu Leu Ala Ala Ser Tyr Asn Val Asp
    270                 275                 280

Ala Trp Thr Phe Leu Ala Gly Tyr Asn Phe Thr Glu Gly Lys Val Ala
285                 290                 295                 300

Ser Asn Thr Ala Gly Ala Glu Tyr Lys Asp Ile Val Asp Glu Thr Leu
                305                 310                 315

Leu Gly Val Gln Tyr Ala Phe Thr Ser Lys Leu Lys Ala Tyr Thr Glu
            320                 325                 330

Tyr Lys Ile Gln Gly Ile Asp Lys Met Asp Asp Glu Trp Thr Val Ala
        335                 340                 345

Leu Gln Tyr Asn Phe
    350
```

<210> 3
<211> 1122
<212> DNA
<213> Aeromonas hydrophila

<220>
<221> CDS
<222> (1)..(1119)

<220>
<221> sig_peptide
<222> (1)..(60)

<220>
<221> mat_peptide
<222> (61)..(1119)

<400> 3

```
atg aaa aag aca att ctg gct att gct atc ccg gct ctg ttt gca tcc       48
Met Lys Lys Thr Ile Leu Ala Ile Ala Ile Pro Ala Leu Phe Ala Ser
-20                 -15                 -10                 -5

gcc gct aac gct gca gtg gtt tac gac aaa gac ggt acc act ttt gac       96
Ala Ala Asn Ala Ala Val Val Tyr Asp Lys Asp Gly Thr Thr Phe Asp
            -1  1               5                  10

gta tac ggc cgt gtt cag gct aac tac tac ggt gac cac aac aaa tct      144
Val Tyr Gly Arg Val Gln Ala Asn Tyr Tyr Gly Asp His Asn Lys Ser
        15                  20                  25

gta gct gct acc gat ggt tcc tgg ggc ttc agc gga act ggt acc ccg      192
Val Ala Ala Thr Asp Gly Ser Trp Gly Phe Ser Gly Thr Gly Thr Pro
    30                  35                  40

gaa tat act cct ggt acc gct gct cat tac tct gat gtt gat ggt gag      240
Glu Tyr Thr Pro Gly Thr Ala Ala His Tyr Ser Asp Val Asp Gly Glu
45                  50                  55                  60

ctg gtt ggt tct tcc cgt ctg ggt tgg tcc ggt aag att gcc ctg aac      288
Leu Val Gly Ser Ser Arg Leu Gly Trp Ser Gly Lys Ile Ala Leu Asn
                65                  70                  75

aac acc tgg tcc ggt atc gcc aag act gag tgg caa gtt tct gct gaa      336
Asn Thr Trp Ser Gly Ile Ala Lys Thr Glu Trp Gln Val Ser Ala Glu
            80                  85                  90

aac tcc gcc aac aag ttc gat tcc cgt cac atc tac gtt ggt ttc gac      384
Asn Ser Ala Asn Lys Phe Asp Ser Arg His Ile Tyr Val Gly Phe Asp
        95                  100                 105

ggc acc cag tac ggt aag atc atc ttc ggt cag acc gat acc gcg ttc      432
Gly Thr Gln Tyr Gly Lys Ile Ile Phe Gly Gln Thr Asp Thr Ala Phe
    110                 115                 120

tat gac gtg ctg gaa ccg acc gat atc ttc aac gag tgg ggc gac gta      480
Tyr Asp Val Leu Glu Pro Thr Asp Ile Phe Asn Glu Trp Gly Asp Val
125                 130                 135                 140

ggt aac ttc tat gac ggt cgt caa gaa ggt cag atc atc tac tcc aac      528
Gly Asn Phe Tyr Asp Gly Arg Gln Glu Gly Gln Ile Ile Tyr Ser Asn
                145                 150                 155

acc tac ggt ggc ttc aaa ggc aaa ctg tcc tat caa acc aac gac gac      576
Thr Tyr Gly Gly Phe Lys Gly Lys Leu Ser Tyr Gln Thr Asn Asp Asp
            160                 165                 170

aag gcc gtc aag gtt act gac gta ggt cag ggc atc aaa gaa aac gca      624
Lys Ala Val Lys Val Thr Asp Val Gly Gln Gly Ile Lys Glu Asn Ala
        175                 180                 185

gtg tac ggc aag gat gtt aag cgt aac tac ggt tat gcc gcg gct gcc      672
Val Tyr Gly Lys Asp Val Lys Arg Asn Tyr Gly Tyr Ala Ala Ala Ala
    190                 195                 200
```

```
ggt tat gac ttc gac ttc ggt ctg ggt ctg aac gca ggt tac tcc tac      720
Gly Tyr Asp Phe Asp Phe Gly Leu Gly Leu Asn Ala Gly Tyr Ser Tyr
205                 210                 215                 220

tcc gat ctg gaa aat acc gca acc aac aac act ggc gac aag aaa gag      768
Ser Asp Leu Glu Asn Thr Ala Thr Asn Asn Thr Gly Asp Lys Lys Glu
                225                 230                 235

tgg gca ctg ggt gca cac tac gcc atc aac ggt ttc tac ttc gcc ggt      816
Trp Ala Leu Gly Ala His Tyr Ala Ile Asn Gly Phe Tyr Phe Ala Gly
            240                 245                 250

gtc tac acc cag gca gat ctg agc tat gac acc acc acc ggt ggt gac      864
Val Tyr Thr Gln Ala Asp Leu Ser Tyr Asp Thr Thr Thr Gly Gly Asp
        255                 260                 265

aag gac aag ggc cgt ggc tac gag ctg gct gct tcc tac aac gtt gat      912
Lys Asp Lys Gly Arg Gly Tyr Glu Leu Ala Ala Ser Tyr Asn Val Asp
    270                 275                 280

gcc tgg act ttc ctg gcc ggc tac aac ttc act gaa ggt aaa gtt gct      960
Ala Trp Thr Phe Leu Ala Gly Tyr Asn Phe Thr Glu Gly Lys Val Ala
285                 290                 295                 300

tcc aac acc gct ggt gct gag tac aaa gac atc gtt gac gaa acc ctg     1008
Ser Asn Thr Ala Gly Ala Glu Tyr Lys Asp Ile Val Asp Glu Thr Leu
                305                 310                 315

ctg ggc gta cag tac gct ttc act tcc aag ctg aaa gcc tac acc gag     1056
Leu Gly Val Gln Tyr Ala Phe Thr Ser Lys Leu Lys Ala Tyr Thr Glu
            320                 325                 330

tac aag atc cag ggt atc gac aag atg gac gac gag tgg acc gtt gcc     1104
Tyr Lys Ile Gln Gly Ile Asp Lys Met Asp Asp Glu Trp Thr Val Ala
        335                 340                 345

ctg caa tac aac ttc taa                                            1122
Leu Gln Tyr Asn Phe
    350
```

<210> 4
<211> 373
<212> PRT
<213> Aeromonas hydrophila

<400> 4

```
Met Lys Lys Thr Ile Leu Ala Ile Ala Ile Pro Ala Leu Phe Ala Ser
-20                 -15                 -10                 -5

Ala Ala Asn Ala Ala Val Val Tyr Asp Lys Asp Gly Thr Thr Phe Asp
            -1  1               5                   10
```

Val Tyr Gly Arg Val Gln Ala Asn Tyr Tyr Gly Asp His Asn Lys Ser
15 20 25

Val Ala Ala Thr Asp Gly Ser Trp Gly Phe Ser Gly Thr Gly Thr Pro
30 35 40

Glu Tyr Thr Pro Gly Thr Ala Ala His Tyr Ser Asp Val Asp Gly Glu
45 50 55 60

Leu Val Gly Ser Ser Arg Leu Gly Trp Ser Gly Lys Ile Ala Leu Asn
65 70 75

Asn Thr Trp Ser Gly Ile Ala Lys Thr Glu Trp Gln Val Ser Ala Glu
80 85 90

Asn Ser Ala Asn Lys Phe Asp Ser Arg His Ile Tyr Val Gly Phe Asp
95 100 105

Gly Thr Gln Tyr Gly Lys Ile Ile Phe Gly Gln Thr Asp Thr Ala Phe
110 115 120

Tyr Asp Val Leu Glu Pro Thr Asp Ile Phe Asn Glu Trp Gly Asp Val
125 130 135 140

Gly Asn Phe Tyr Asp Gly Arg Gln Glu Gly Gln Ile Ile Tyr Ser Asn
145 150 155

Thr Tyr Gly Gly Phe Lys Gly Lys Leu Ser Tyr Gln Thr Asn Asp Asp
160 165 170

Lys Ala Val Lys Val Thr Asp Val Gly Gln Gly Ile Lys Glu Asn Ala
175 180 185

Val Tyr Gly Lys Asp Val Lys Arg Asn Tyr Gly Tyr Ala Ala Ala Ala
190 195 200

Gly Tyr Asp Phe Asp Phe Gly Leu Gly Leu Asn Ala Gly Tyr Ser Tyr
205 210 215 220

Ser Asp Leu Glu Asn Thr Ala Thr Asn Asn Thr Gly Asp Lys Lys Glu
225 230 235

Trp Ala Leu Gly Ala His Tyr Ala Ile Asn Gly Phe Tyr Phe Ala Gly

```
            240                 245                 250

Val Tyr Thr Gln Ala Asp Leu Ser Tyr Asp Thr Thr Thr Gly Gly Asp
        255                 260                 265

Lys Asp Lys Gly Arg Gly Tyr Glu Leu Ala Ala Ser Tyr Asn Val Asp
    270                 275                 280

Ala Trp Thr Phe Leu Ala Gly Tyr Asn Phe Thr Glu Gly Lys Val Ala
285                 290                 295                 300

Ser Asn Thr Ala Gly Ala Glu Tyr Lys Asp Ile Val Asp Glu Thr Leu
                305                 310                 315

Leu Gly Val Gln Tyr Ala Phe Thr Ser Lys Leu Lys Ala Tyr Thr Glu
            320                 325                 330

Tyr Lys Ile Gln Gly Ile Asp Lys Met Asp Asp Glu Trp Thr Val Ala
        335                 340                 345

Leu Gln Tyr Asn Phe
    350
```

<210> 5
<211> 60
<212> DNA
<213> Aeromonas hydrophila

<220>
<221> CDS
<222> (1)..(60)

<400> 5

```
atg aaa aag aca att ctg gct att gct atc ccg gct ctg ttt gca tcc       48
Met Lys Lys Thr Ile Leu Ala Ile Ala Ile Pro Ala Leu Phe Ala Ser
1               5                   10                  15

gcc gct aac gct                                                      60
Ala Ala Asn Ala
            20
```

<210> 6
<211> 20
<212> PRT
<213> Aeromonas hydrophila

<400> 6

```
Met Lys Lys Thr Ile Leu Ala Ile Ala Ile Pro Ala Leu Phe Ala Ser
1               5                   10                  15

Ala Ala Asn Ala
            20
```

<210> 7
<211> 1062
<212> DNA
<213> Aeromonas hydrophila

<220>
<221> CDS
<222> (1)..(1059)

<400> 7

```
gca gtg gtt tac gac aaa gac ggt acc act ttt gac gta tac ggc cgt       48
Ala Val Val Tyr Asp Lys Asp Gly Thr Thr Phe Asp Val Tyr Gly Arg
1               5                   10                  15

gtt cag gct aac tac tac ggt gac cac aac aaa tct gta gct gct acc       96
Val Gln Ala Asn Tyr Tyr Gly Asp His Asn Lys Ser Val Ala Ala Thr
            20                  25                  30

gat ggt tcc tgg ggc ttc agc gga act ggt acc ccg gaa tat act cct      144
Asp Gly Ser Trp Gly Phe Ser Gly Thr Gly Thr Pro Glu Tyr Thr Pro
        35                  40                  45

ggt acc gct gct cat tac tct gat gtt gat ggt gag ctg gtt ggt tct      192
Gly Thr Ala Ala His Tyr Ser Asp Val Asp Gly Glu Leu Val Gly Ser
    50                  55                  60

tcc cgt ctg ggt tgg tcc ggt aag att gcc ctg aac aac acc tgg tcc      240
Ser Arg Leu Gly Trp Ser Gly Lys Ile Ala Leu Asn Asn Thr Trp Ser
65                  70                  75                  80

ggt atc gcc aag act gag tgg caa gtt tct gct gaa aac tcc gcc aac      288
Gly Ile Ala Lys Thr Glu Trp Gln Val Ser Ala Glu Asn Ser Ala Asn
                85                  90                  95

aag ttc gat tcc cgt cac atc tac gtt ggt ttc gac ggc acc cag tac      336
Lys Phe Asp Ser Arg His Ile Tyr Val Gly Phe Asp Gly Thr Gln Tyr
            100                 105                 110

ggt aag atc atc ttc ggt cag acc gat acc gcg ttc tat gac gtg ctg      384
Gly Lys Ile Ile Phe Gly Gln Thr Asp Thr Ala Phe Tyr Asp Val Leu
        115                 120                 125

gaa ccg acc gat atc ttc aac gag tgg ggc gac gta ggt aac ttc tat      432
Glu Pro Thr Asp Ile Phe Asn Glu Trp Gly Asp Val Gly Asn Phe Tyr
    130                 135                 140

gac ggt cgt caa gaa ggt cag atc atc tac tcc aac acc tac ggt ggc      480
```

```
Asp Gly Arg Gln Glu Gly Gln Ile Ile Tyr Ser Asn Thr Tyr Gly Gly
145                 150                 155                 160

ttc aaa ggc aaa ctg tcc tat caa acc aac gac gac aag gcc gtc aag      528
Phe Lys Gly Lys Leu Ser Tyr Gln Thr Asn Asp Asp Lys Ala Val Lys
                165                 170                 175

gtt act gac gta ggt cag ggc atc aaa gaa aac gca gtg tac ggc aag      576
Val Thr Asp Val Gly Gln Gly Ile Lys Glu Asn Ala Val Tyr Gly Lys
            180                 185                 190

gat gtt aag cgt aac tac ggt tat gcc gcg gct gcc ggt tat gac ttc      624
Asp Val Lys Arg Asn Tyr Gly Tyr Ala Ala Ala Ala Gly Tyr Asp Phe
        195                 200                 205

gac ttc ggt ctg ggt ctg aac gca ggt tac tcc tac tcc gat ctg gaa      672
Asp Phe Gly Leu Gly Leu Asn Ala Gly Tyr Ser Tyr Ser Asp Leu Glu
    210                 215                 220

aat acc gca acc aac aac act ggc gac aag aaa gag tgg gca ctg ggt      720
Asn Thr Ala Thr Asn Asn Thr Gly Asp Lys Lys Glu Trp Ala Leu Gly
225                 230                 235                 240

gca cac tac gcc atc aac ggt ttc tac ttc gcc ggt gtc tac acc cag      768
Ala His Tyr Ala Ile Asn Gly Phe Tyr Phe Ala Gly Val Tyr Thr Gln
                245                 250                 255

gca gat ctg agc tat gac acc acc acc ggt ggt gac aag gac aag ggc      816
Ala Asp Leu Ser Tyr Asp Thr Thr Thr Gly Gly Asp Lys Asp Lys Gly
            260                 265                 270

cgt ggc tac gag ctg gct gct tcc tac aac gtt gat gcc tgg act ttc      864
Arg Gly Tyr Glu Leu Ala Ala Ser Tyr Asn Val Asp Ala Trp Thr Phe
        275                 280                 285

ctg gcc ggc tac aac ttc act gaa ggt aaa gtt gct tcc aac acc gct      912
Leu Ala Gly Tyr Asn Phe Thr Glu Gly Lys Val Ala Ser Asn Thr Ala
    290                 295                 300

ggt gct gag tac aaa gac atc gtt gac gaa acc ctg ctg ggc gta cag      960
Gly Ala Glu Tyr Lys Asp Ile Val Asp Glu Thr Leu Leu Gly Val Gln
305                 310                 315                 320

tac gct ttc act tcc aag ctg aaa gcc tac acc gag tac aag atc cag     1008
Tyr Ala Phe Thr Ser Lys Leu Lys Ala Tyr Thr Glu Tyr Lys Ile Gln
                325                 330                 335

ggt atc gac aag atg gac gac gag tgg acc gtt gcc ctg caa tac aac     1056
Gly Ile Asp Lys Met Asp Asp Glu Trp Thr Val Ala Leu Gln Tyr Asn
            340                 345                 350

ttc taa                                                            1062
Phe
```

<210> 8

<211> 353
<212> PRT
<213> Aeromonas hydrophila

<400> 8

```
Ala Val Val Tyr Asp Lys Asp Gly Thr Thr Phe Asp Val Tyr Gly Arg
1               5                  10                  15

Val Gln Ala Asn Tyr Tyr Gly Asp His Asn Lys Ser Val Ala Ala Thr
            20                  25                  30

Asp Gly Ser Trp Gly Phe Ser Gly Thr Gly Thr Pro Glu Tyr Thr Pro
        35                  40                  45

Gly Thr Ala Ala His Tyr Ser Asp Val Asp Gly Glu Leu Val Gly Ser
    50                  55                  60

Ser Arg Leu Gly Trp Ser Gly Lys Ile Ala Leu Asn Asn Thr Trp Ser
65                  70                  75                  80

Gly Ile Ala Lys Thr Glu Trp Gln Val Ser Ala Glu Asn Ser Ala Asn
                85                  90                  95

Lys Phe Asp Ser Arg His Ile Tyr Val Gly Phe Asp Gly Thr Gln Tyr
            100                 105                 110

Gly Lys Ile Ile Phe Gly Gln Thr Asp Thr Ala Phe Tyr Asp Val Leu
        115                 120                 125

Glu Pro Thr Asp Ile Phe Asn Glu Trp Gly Asp Val Gly Asn Phe Tyr
    130                 135                 140

Asp Gly Arg Gln Glu Gly Gln Ile Ile Tyr Ser Asn Thr Tyr Gly Gly
145                 150                 155                 160

Phe Lys Gly Lys Leu Ser Tyr Gln Thr Asn Asp Asp Lys Ala Val Lys
                165                 170                 175

Val Thr Asp Val Gly Gln Gly Ile Lys Glu Asn Ala Val Tyr Gly Lys
            180                 185                 190

Asp Val Lys Arg Asn Tyr Gly Tyr Ala Ala Ala Ala Gly Tyr Asp Phe
        195                 200                 205
```

```
Asp Phe Gly Leu Gly Leu Asn Ala Gly Tyr Ser Tyr Ser Asp Leu Glu
    210                 215                 220

Asn Thr Ala Thr Asn Asn Thr Gly Asp Lys Lys Glu Trp Ala Leu Gly
225                 230                 235                 240

Ala His Tyr Ala Ile Asn Gly Phe Tyr Phe Ala Gly Val Tyr Thr Gln
                245                 250                 255

Ala Asp Leu Ser Tyr Asp Thr Thr Thr Gly Gly Asp Lys Asp Lys Gly
            260                 265                 270

Arg Gly Tyr Glu Leu Ala Ala Ser Tyr Asn Val Asp Ala Trp Thr Phe
        275                 280                 285

Leu Ala Gly Tyr Asn Phe Thr Glu Gly Lys Val Ala Ser Asn Thr Ala
    290                 295                 300

Gly Ala Glu Tyr Lys Asp Ile Val Asp Glu Thr Leu Leu Gly Val Gln
305                 310                 315                 320

Tyr Ala Phe Thr Ser Lys Leu Lys Ala Tyr Thr Glu Tyr Lys Ile Gln
                325                 330                 335

Gly Ile Asp Lys Met Asp Asp Glu Trp Thr Val Ala Leu Gln Tyr Asn
            340                 345                 350

Phe
```

<210> 9
<211> 20
<212> PRT
<213> Aeromonas hydrophila strain PPD

<300>
<301> SY Lee, Z Yin, R Ge, YM Sin
<302> Isolation and characterization of fish Aeromonas hydrophila adhesins important for in vitro epithelial cell invasion
<303> Journal of Fish Diseases
<304> 20
<305> 3
<306> 169-175
<307> 1997-05
<313> (1)..(20)

<400> 9

Ala Val Phe Tyr Asp Lys Asp Gly Thr Thr Phe Asp Val Tyr Gly Arg
1 5 10 15

Val Gln Ala Asn
20